Pricing practices of unregulated firms

The above discussion should make it abundantly clear that the Mayo and Kasserman perception of how firms operate has little to do with actual business decisions made by firms. Through the use of simplistic economic models, they derive conclusions that have little or nothing to do with the actual behavior of markets in which there is rivalry and economies of scale and scope (on both the demand and supply side). While this paper does not suggest that all value-of-service pricing is optimal, it clearly indicates that such behavior is a common occurrence in competitive markets and is looked upon by firms as a viable strategic tool to employ in pursuing profitability.

For telecommunications analysts and regulators, the path ahead is obvious. They must move beyond the simplistic models which argue that competition drives price to marginal cost and look instead at the actual pricing behavior of various industries. Then it becomes immediately clear that we would not witness the type of pricing schedules we do in the Internet Service Provider, Credit Card, and transportation markets, to name a few examples. Businessmen in competitive markets have long realized something that too few utility economists recognize; you want to get customers in the door, not charge a large access fee that acts as a barrier. This is why we have seen what we have seen, for example, in the credit card industry, the disappearance of access fees.

The mantra that competitive markets drive prices to cost is reasonable to some extent. Where economic profits are being earned, there is an incentive for competitive entry. On the other hand, competitive entry does not mean that each price is set equal to the cost-of-production. The above discussion shows that in markets in which rivalry exists or is threatened, for various strategic reasons, firms do not set price equal to cost. Rather, consistent with recent empirical and theoretical work in economics, if anything, rivalry compels firms to create more elaborate forms of price discrimination.

Welfare gains from rebalancing

Advocates of higher customer access line charges claim that there will be efficiency gains from the rebalancing of rates. When they estimate the magnitude of these gains, they tally the addition and loss of individuals, using dollars transferred as the measure of utility. This utilitarian approach to

policy analysis typically computes the costs and benefits, without regard to which individuals receive those benefits.[95]

This method of aggregation has been found objectionable by some policy makers and advocates. For example, in a hearing before the Oregon Public Utility Commission, two economists who favored rebalancing noted that an increase in exchange rates permitted the utilities to lower the price of vertical services. Since the demand for vertical services was comparatively elastic relative to exchange service, they argued that this was welfare-enhancing. Rate-rebalancing might lead to a few customers dropping off the network, but according to the utilitarian methodology subscribed to by these witnesses, this loss would be small compared to the increased number of subscribers who would benefit from the reduction in the price of vertical services. When a lawyer inquired "how many new sign-ups for call forwarding would justify the loss of basic service to one-household, the response was, '11.'" [footnote omitted]...[W]hen asked whether their analysis took into consideration the difficulty of summoning assistance in emergencies for households forced off the system by [rebalancing]..., they responded that they had not taken that factor into consideration."[96] This exchange depicts both the difficulty in assessing the welfare superiority of different pricing structures and the shallow intellectual foundation for the empirical work that has been used to justify efficiency gains derived from rate-rebalancing.

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[95]John T. Wenders, "Two Views of Applied Welfare Analysis: The Case of Local Telephone Service Pricing," Southern Journal of Economics 57 (1989), p. 340.

This simplistic approach to welfare analysis assumes that a millionaire and a homeless person obtain the same marginal utility from an additional dollar of income. More complicated welfare functions exist that take into account other factors, such as the distribution of income. Vincent Snowberger has noted that once these additional considerations are weighed, the utilitarian literature provides little policy guidance: "There are enough different forms for the equations yielding a [welfare-maximizing] output-price vector—each form representing a different set of assumptions—and enough difficulties associated with empirically incorporating some of the assumptions that it is tempting to conjecture that, confronted with an arbitrary vector one wishes to justify, one can work backwards to find the assumptions and the particular quantification of them which makes the vector Ramsey optimal." "Sustainability Theory: Its Implications for Governmental Preservation in a Regulated Monopoly," v. 18 (Winter 1978) Quarterly Review of Economics and Business, p. 84.

[96]Michael Sheehan, "Why Ramsey Pricing is Wrong: The Case of Telecommunications Regulation," Journal of Economic Issues 25 (March 1991), pp. 21-22.

An alternative approach for measuring the benefit of different policies is to judge them based on an evaluation of individual behavior. John Wenders points out that relying on individual decisions, rather than some arbitrary welfare function, is the essence of competitive markets: "But the desirability of the competitive approach is not that it maximizes the sum of the surplus, but that it maximizes individual voluntary exchanges, each of which leave both parties better off."[97] This Chapter has demonstrated how in competitive markets, low access fees are the more successful pricing strategy. By Wenders' criteria, this is also the welfare-maximizing pricing structure.

Rebalancing and toll usage

A close look at competitive market behavior clearly demonstrates that where rivalry exists, prices are not driven to cost. Firms do not recover the cost of customer access exclusively through fixed customer charges. Rather, this shared cost is recovered from all of the products that the firms sell.

Proponents of rate-rebalancing tend to ignore discussions of how markets work; instead, they present data that make a very compelling case that economic efficiency would increase if rates were rebalanced. They mention that the price-elasticity for access and exchange service is relatively low in comparison with toll service. Therefore, even if the access line is a shared cost, Ramsey pricing principles require that the shared cost be recovered principally from the most inelastic services.[98]

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[97]Wenders, "Two Views," p. 340.

[98]Ramsey pricing essentially requires that a comparatively large margin be earned in those markets with the lowest price-elasticity of demand. Few States have adopted the concept of Ramsey pricing; the data requirements cannot be met, and the rule becomes quite complicated once the social welfare function includes income considerations. "[U]p-to-date estimates of the full set of pertinent elasticities and cross-elasticities are virtually impossible to calculate, particularly in markets where demand conditions change frequently and substantially. As a result, an attempt to provide the regulator with an extensive set of Ramsey prices is likely to be beset by inaccuracies, by obsolete demand data, and by delays that will prevent the firm from responding promptly and appropriately to evolving market conditions." William Baumol and J. Gregory Sidak, *Toward Competition in Local Telephony* (Cambridge: MIT Press, 1994), 39.

In 1993, in an article coauthored by Mark Kennet, we stated that the price-elasticity estimates used to support the rebalancing position are flawed because of econometric aggregation and specification problems.[99] Rather than summarize the discussion of these technical issues, I will provide some simple, descriptive statistics which illuminate why I believe the elasticity estimates used by advocates of rebalancing are seriously flawed. Econometric estimates of the price elasticity of demand are typically modeled as a function of income, the size of the market, the real price of toll service, and, sometimes, the prices of complements and substitutes. I believe that these models do not do a good job in explaining the variation in the demand for service.

The studies typically show a much higher price elasticity of demand for interstate relative to intrastate toll service.[100] To better delineate the errors in these studies, consider, for example, the data that appear in Figure One. For the State of Maine, the price of intrastate toll service remained essentially unchanged during the years 1984 through 1991. During those same years, the price of interstate toll service declined about 30 %. The simple econometric models that advocates of rebalancing rely on would suggest that given these price changes, there would be a significantly larger increase in the demand for interstate than in the demand for intrastate toll service in Maine. This demand would be characterized as an efficiency gain. The data do not support this proposition. Instead, they show that the demand for intrastate and interstate service grew in tandem, despite quite different pricing trends.

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[99]"Pricing of Telecommunication Services," with Mark Kennet. Review of Industrial Organization. 1993. pp. 1-14.

[100]Lester Taylor, Telecommunications Demand: A Survey and Critique (1980), Cambridge, MA: Ballinger.

FIGURE ONE

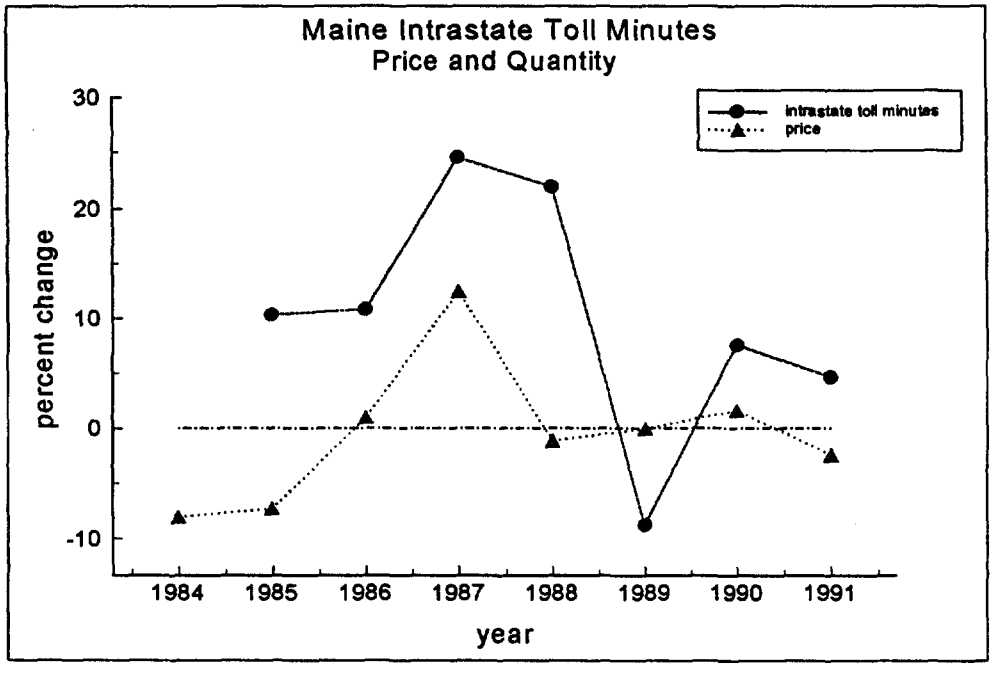
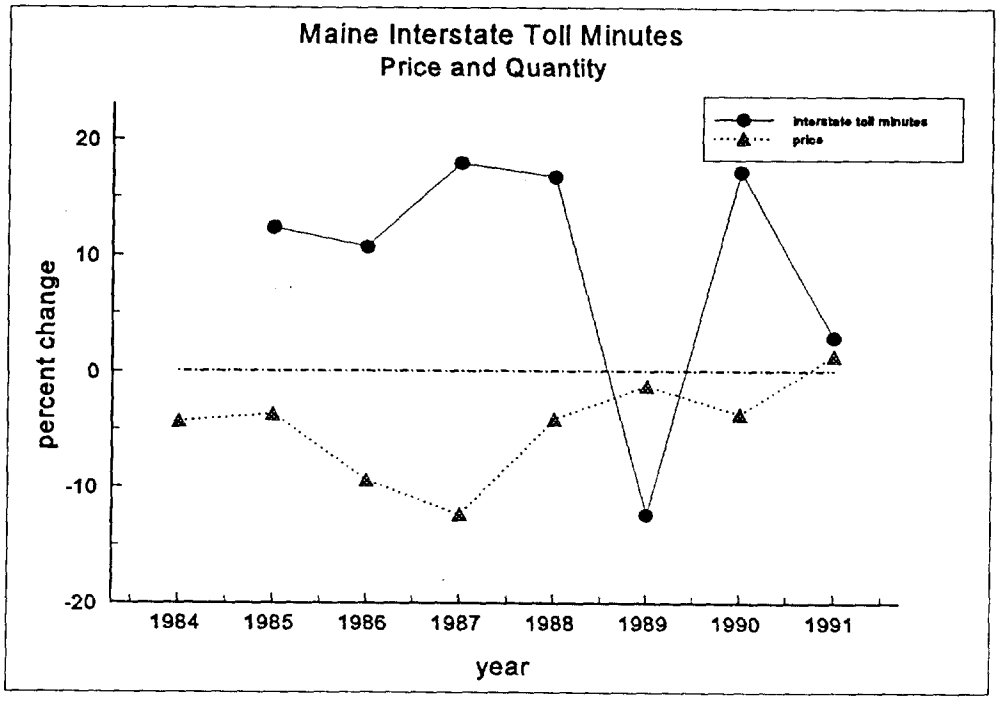
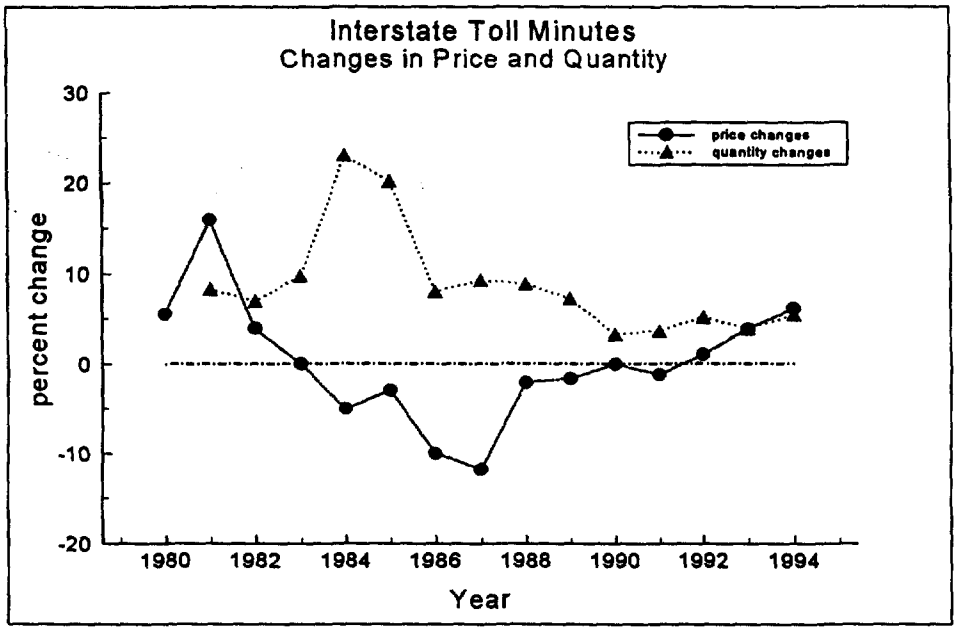

Maine Intrastate Toll Minutes
Price and Quantity
intrastate toll minutes
price
30
20
10
0
-10
percent change
1984
1985
1986
1987
1988
1989
1990
1991
year

FIGURE ONE (CONTINUED)



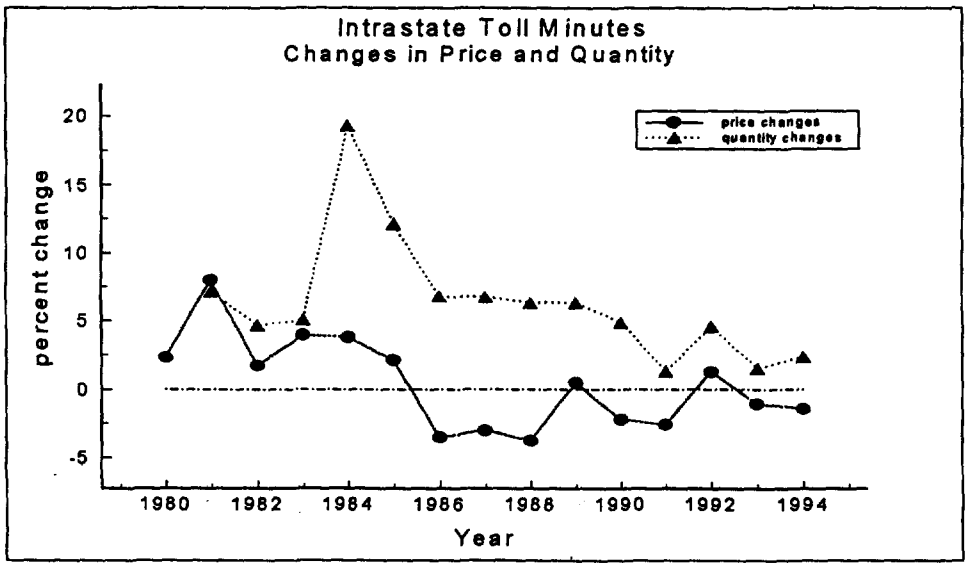
Neither do the nationwide data shown in Figure Two uniformly support the proposition that declines in the price of interstate toll service led to a sizeable increase in the toll minutes-of-use associated with interstate traffic. For example, in the period 1992-1994, interstate minutes-of-use increased along with the price.

FIGURE TWO



Source: Federal Communications Commission

FIGURE TWO (CONTINUED)

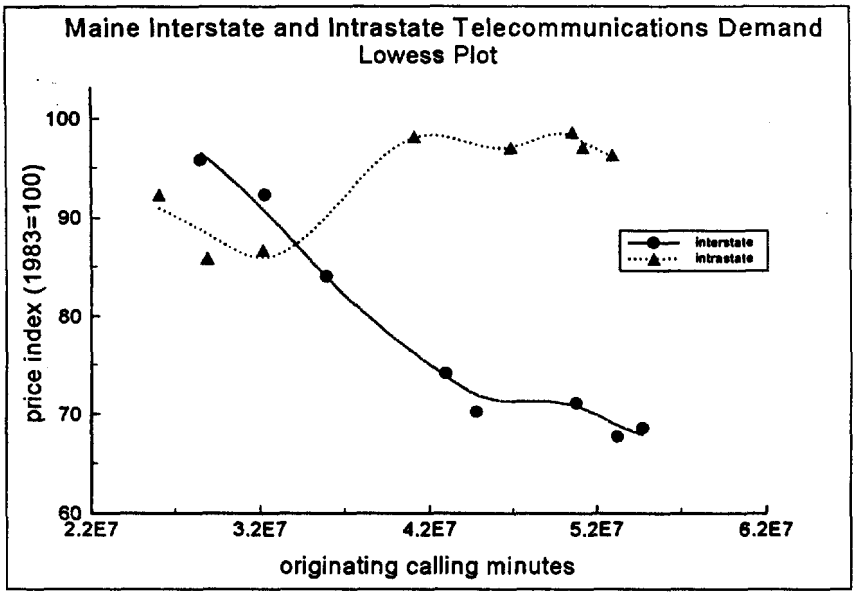


Source: Federal Communications Commission

The data from Maine most pointedly depict that the growth in long-distance usage is driven by many factors other than price. The failure to reflect adequately these various factors in the demand models has led to biased estimates of the price elasticity of demand. These biased estimates have been used to overstate the "efficiency" gains that could be achieved through rate-rebalancing. Redrawing the data from Figure One with the Lowess smoothing technique as a supply-demand relationship shows this more clearly (Figure Three)[101]

[101]While it is more traditional to use a regression fit for supply and demand data, I chose the Lowess technique here because the data were so apparently nonlinear. This is a nonparametric technique that fits the "best" curve to a data set showing the relationship between two variables (in this case, price and quantity).

FIGURE THREE

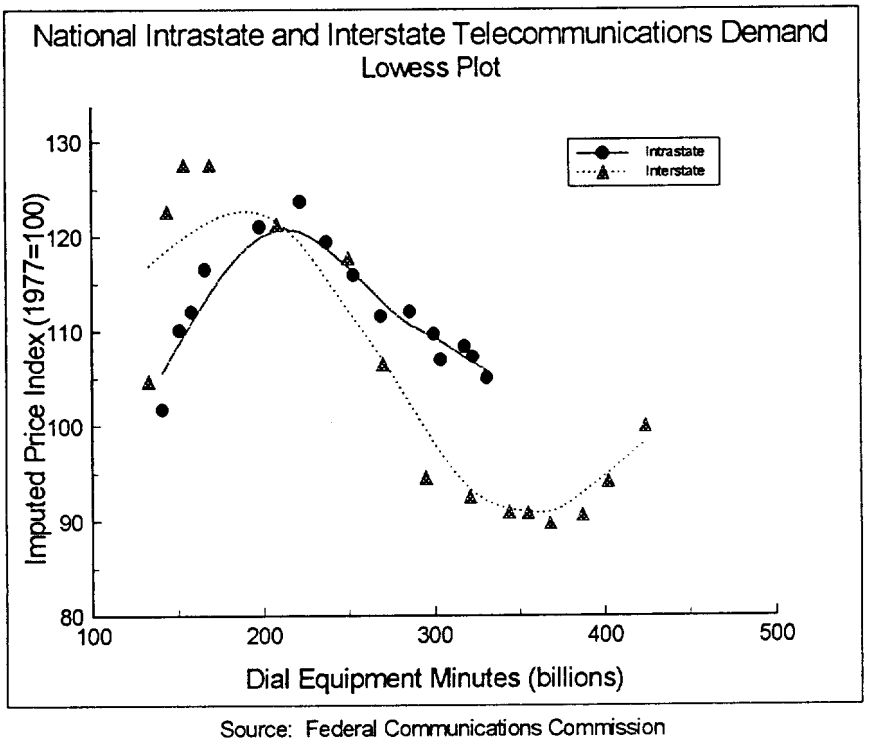


Here, we observe that while interstate calling minutes follow the traditional downward sloping demand curve, the shape of the intrastate relationship is more or less flat. This suggests very different elasticity values than are used in the studies that show the welfare gains from rate-rebalancing. Figure Four (which uses the same data as Figure Two) shows that in the early years of the time series, nationwide demand was driven more by rising income or other factors than by toll prices. However, later data show the effect of the steady price declines, with intrastate exhibiting a somewhat larger price elasticity than interstate.

Regardless of the correct measurement of the price elasticity of demand for various telephone services, one essential question remains: if rebalancing raises welfare, why does the government have to impose this outcome? I do not believe that rebalancing would occur in a competitive market and the economists employed by utilities are sponsoring a position which is contrary to the behavior of

markets in which rivalry is present. That consumers choose to use tariffs that do not include high

FIGURE FOUR



Source: Federal Communications Commission

customer access charges strongly suggests that rebalancing is not welfare enhancing. For if it were, consumers would select the allegedly "efficient" pricing structure.

CHAPTER III: Measuring the Cost of Universal Service

Measuring the cost of universal service

In the Universal Service Docket last year, the Florida Public Service Commission said that the required magnitude of the universal subsidy should be estimated with reference to the incremental cost-of-production.[102] In this section of the paper, I address the ability of the Benchmark and Hatfield Cost Models to estimate the incremental cost-of-production. This is preceded by a discussion of the costing principles that should be adopted. The methodology that I describe is not used in either model.

There is substantial agreement over the elements of universal service (see page 4 of this report). Furthermore, there is a general agreement as to how the cost of providing universal service should be calculated. The cost of providing universal service is the difference between the cost of and the revenue derived from supplying the universal service products.

Around the world, nations have used an avoided-cost methodology to quantify the cost of the universal service obligation. This standard has emerged because it reflects the type of information that a business would use to appraise the profitability of an undertaking. In a non-regulated market, a commercial operator would measure the benefit or burden of a service by comparing its incremental costs and revenues. The framework used by unregulated businesses should be used to appraise the burden of the universal service obligation.

The purpose of the avoided-cost methodology is to identify those expenses that would not be incurred if an area or group of customers no longer received service. In the process of developing the avoided costs, joint and common costs that are unavoidable are not included in the measurement of the direct cost of providing universal service products. As shown in the Figure below, the methodology identifies both the avoidable costs and revenues. The foregone revenues include not only exchange revenue, but also earnings from toll and vertical services. The revenue calculation must also take into account the revenue derived from calls made to the universal service customers.[103] This is,

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[102]Re: Determination of funding for universal service and carrier of last resort responsibilities, Florida Public Service Commission, Docket No. 950696-TP, December 27, 1995, p. 28.

[103]Oftel (United Kingdom), "A Framework for Effective Competition," Appendix C, Par. C13, December 1994.

of course, the criteria used by AT&T during the competitive, unregulated period at the start of the twentieth century.

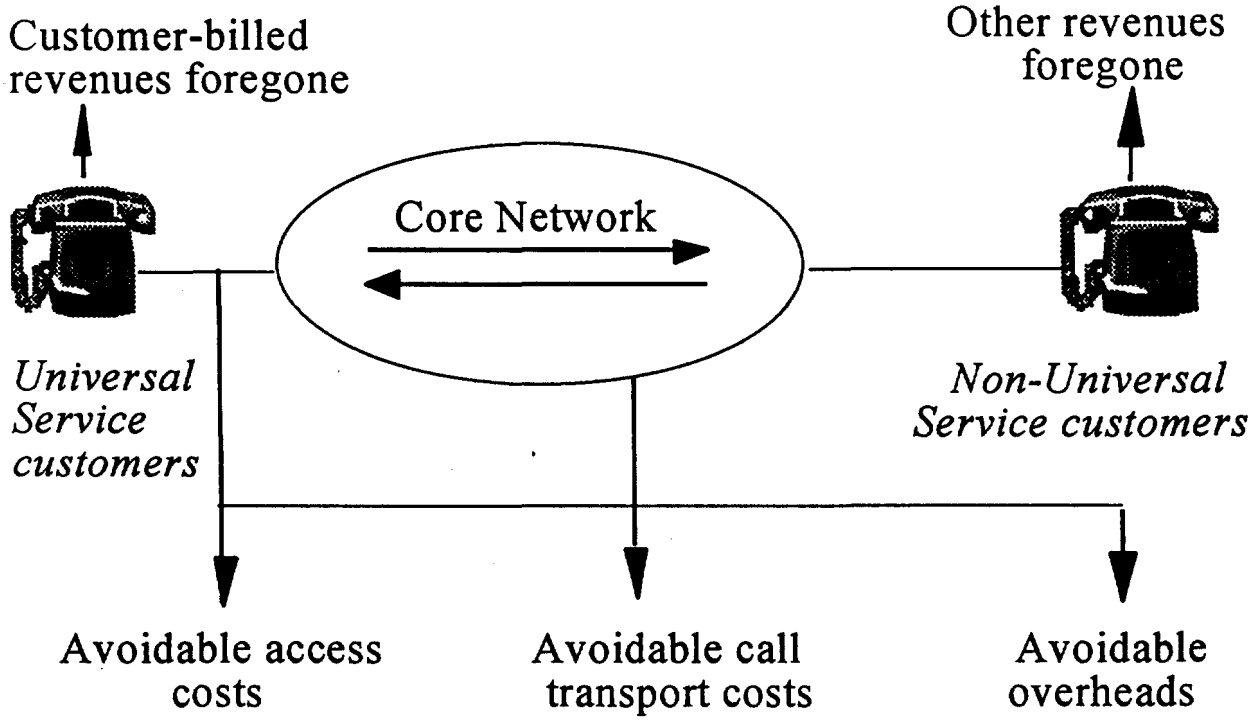
Recently, OFTEL gave the following description of the method it uses to calculate the cost of a local exchange company's universal service obligation: "OFTEL's approach to calculating the costs of universal service in the United Kingdom is generally to identify and establish the cost to [a LEC] of customers whose revenues, including revenues from incoming calls, falls short of the long run avoidable costs of providing them with service. The estimated value of the benefits of being the universal service provided is then subtracted." See, also, Oftel, "Universal Telecommunications Services: A Consultative Document on Universal Service in the UK from 1997 (December 1995), Par. 9.3

The Chairman of the Federal Communications Commission, Reed Hundt, has recognized the reasonableness of this methodology and its adoption by Oftel in the United Kingdom:

> And where subsidies are needed for the poor or the very high cost area, as OFTEL has demonstrated for the U.K., they are modest. That is because telephone operators receive commercial benefits from broader network coverage. The benefits of broader coverage off set some of the costs of uneconomic connections to some homes and regions.

"Seven Habits of Hopefully Highly Successful Deregulatory Communications Policy People." Royal Institute of International Affairs, London, England, September 4, 1996.

Figure 1: Avoidable Costs And Revenues Foregone Of Serving Customers



The Florida Public Service Commission, like other regulatory agencies, has argued that only residential service should be provided universal service subsidies. The Commission believes that there is a widespread consensus in the industry that business customers pay rates that exceed the cost of providing them service. Therefore, the measurement of the cost of providing universal service should

be based on an analysis of the incremental costs and revenues associated with residential services.[104]

Economists, following Faulhaber (1975), have established that total service long run incremental cost (TSLRIC) should be used to test for service subsidies.[105] As long as a group of consumers, such as residential customers, are generating additional revenue that exceeds the cost of including them on the network, this group is not being subsidized in any way by other groups of customers or other services.

An economically valid estimate for the existence of a subsidy, using the TSLRIC criteria, must reflect the fact that business and private line services would still exist if residential service were eliminated. If a local service network operator did not offer residential service, perhaps because it believed that it was not viable and there was no requirement to do so, it would nevertheless still wire many areas of the country in order to provide service to businesses.

Therefore, the TSLRIC of residential service is the cost of adding residential service to a network that already provides business services, including both switched business and private line services. This means that the TSLRIC of residential service would be the cost of wiring areas containing only residential neighborhoods, as well as the cost of installing larger cables in regions that would otherwise still be wired in order to provide service to business customers. This methodology is consistent with the economic principle that the incremental cost of providing a service is the cost that would be avoided if this one service were discontinued, while all other services continued.

Neither the Benchmark nor Hatfield models use this methodology. They estimate the cost of serving different areas, but they do not identify the incremental cost of serving residential customers. Rather than identify the incremental cost-of-production, these cost studies typically estimate the average cost-of-production. For example, neither the Benchmark nor Hatfield models estimate the

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[104]"Comments," Florida Public Service Commission, "In the Matter of: Federal-State Joint Board on Universal Service," p. 7, CC Docket No. 96-45, April 11, 1996; and Re: Determination of funding for universal service and carrier of last resort responsibilities, Florida Public Service Commission, Docket No. 950696-TP, December 27, 1995, pp. 8, 25.

[105]Gerald Faulhaber, "Cross-Subsidization: Pricing in Public Enterprise," American Economic Review, December 1975, pp. 966-77.

total service long run incremental cost of a residence, business, or private line loop. Instead, they estimate the total cost of installing loops, then divide this quantity by the number of working loops.[106] The quotient is an average cost, not the TSLRIC of a service. This average cost estimate should serve more as a rate-ceiling, rather than a rate-floor.

If only residential services are being considered suitable for a universal service subsidy or support, the cost analyst should compare the incremental cost of the service with its revenue. If a family of products are being studied, the analyst should compare the family's incremental costs and revenues. If the family's costs exceed its revenues, then it is being subsidized. The Benchmark and Hatfield models identify the cost of providing both business and residential loops, rather than the incremental cost of offering only residential loops. This being the case, the revenue from all the services that use the loop, not just residential exchange service, ought to be used when comparing costs and revenues.[107] The methodology used by the Benchmark and Hatfield models is flawed, because it compares the average cost of all services with the incremental revenue from a subset of the services. Either the revenue considered should include all services, including revenue derived from business customers, or the cost study should only consider the incremental cost and revenue of residential service.

The Hatfield and Benchmark models aggregate business and residential loops when estimating the cost-of-service. Costs that are considered shared in the individual service studies may become direct in the aggregated studies. For instance, if a company offers two classes of service (e.g.; business and residence) and it studies the cost of those services separately, the fiber feeder cable is not likely to exhaust and it may properly be considered a shared cost in each study. The cable would not be directly attributable to either service. But, if customer access is the "service" in question and residence and business are studied together, then the fiber feeder cable may properly be considered a direct cost of access service.

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[106] See, for example, "Benchmark Cost Model," A Joint Submission of MCI, NYNEX, Sprint, and US West, CC Docket No. 80-286, December 1, 1995.

[107] This view is reflected in the Florida Commission's decision in Re: Determination of funding for universal service and carrier of last resort responsibilities, Florida Public Service Commission, Docket No. 950696-TP, December 27, 1995, at 25.

Costs that are excluded from a service-specific study may be included when a family of products is studied. But when testing for subsidies, a consistent methodology should be used. If cost data from a family of products are being used, family-product revenues must also be taken into account. Instead of looking at the price-cost relationship for an individual service, the total family of products must be included. Fiber expenditures are included in the incremental cost measurement when both business and residence services are being considered. Therefore, the cost estimates that include fiber feeder costs should be compared to the combined revenues from business and residential services. Both the Hatfield and Benchmark models have erred by including family-product costs but not family-product revenues. Consequently, the estimates of the universal service obligation derived from these models are overstated.

I suspect that the magnitude of this error is large. Each time a cable is installed, certain fixed costs per foot are incurred. In many places, this fixed cost is not part of the TSLRIC of residential services because the same expenditure would be required for business service. In such locales, the TSLRIC of residential service should include only the incremental expense of additional pairs of cable and should not include the fixed cost per foot of installing the cable. The TSLRIC of residential service is the cost which would be avoided if any LEC continued to provide private line and switched services to business customers. Neither the Hatfield nor Benchmark models estimate this incremental cost; instead they report the average cost-of-service.

The difference between incremental and average costs is nicely summarized in the seminal cost study undertaken by the Australian government, "The Cost of Telecom's Community Services Obligations:"

> The difference between the avoidability and FDC [fully distributed, or average cost] approaches essentially lies in the treatment of joint or common costs. In the avoidability approach, only avoidable costs are included in the [universal service] cost measure; in the FDC approach, all costs are allocated whether or not they would be incurred if [universal service] had not been provided. There is also a major difference in the treatment of revenue. In the avoidability approach incoming call revenue is included as well as outgoing call revenue, resulting in higher revenue being considered than in the FDC approach.[108]

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[108]Australian Bureau of Transport and Communications Economics, "The Cost of Telecom's Community Service Obligations," (Canberra, 1989), p. 17.

The Florida Commission has determined that the cost of the universal service obligation should be based on the incremental cost-of-production. The Benchmark and Hatfield models do not currently provide the incremental cost of providing service to residential customers, the customer-class that the Commission believes should receive support. If an LEC claims to need universal service support, it should be required to file a cost study that identifies the costs and revenues which would be avoided if the government did not require them to provide universal-service-related products.

Life cycle effects

When measuring the difference between avoided costs and revenues, the analyst might also take into consideration the life cycle of customers' behavior. While a customer or geographic area may not be profitable today, an LEC may still find it profitable to provide service because of the potential future earnings. As discussed in a report commissioned by the United Kingdom's regulatory agency, OFTEL, unregulated firms continue to provide service to some unprofitable customers because of the belief that service to these customers may eventually become profitable to serve and in order to avoid harm to the corporation's image:

> The sheer number of uneconomic residential lines... (10 percent of residential lines) or ... (9 percent of residential lines) makes it seem unlikely that BT [the LEC] would withdraw from this activity even if it were allowed to. However, we must address the serious commercial issue as to whether BT would behave in this way if the universal service activities were subject to normal competitive pressures.
>
> BT, like any other commercial company operating a primarily subscription-based service (e.g.; a bank or building society), could be expected voluntarily to carry a certain number of customers who are 'uneconomic' at a given moment in time. Studies in the building society sector[footnote omitted] indicate that about 40 percent of ordinary accounts are uneconomic at any one moment. Of these, about three quarters are expected to become economic at some future moment, through an increase in the account balance or the purchase of related services such as a mortgage. This leaves a 'hard core' of 25 percent of unprofitable customers (or about 10 percent of all customers) which the building societies could, in theory, get rid of in order to increase their short-term profitability without putting future business at risk.
>
> It can be argued that telecoms and savings are very different businesses, with different cost and revenue structures. However, these differences mainly relate to the higher proportion of uneconomic customers (40 percent in building societies versus 9 percent or 10 percent among

telecoms customers), rather than the proportion of these customers which a firm in a competitive market might want to retain (75 percent). This latter figure, which building societies have calculated primarily using consumer life-cycle effects, might apply to any industry which addresses a national mass consumer market on an almost indiscriminate basis.

In practice, only one building society, the Halifax, has recently taken public action to encourage customers to close uneconomic accounts (and then only for a limited period). Building societies know which accounts are uneconomic, but in general they take little or no action to close these accounts, because:

1) uneconomic accounts may become economic in the future
2) uneconomic accounts may lead to other profitable business□
3) closure of uneconomic accounts may adversely affect other accounts or alternatively some uneconomic accounts may positively contribute to the corporate image.

The first two of these points are life-cycle effects; the last relates to corporate image which has been discussed above.[109]

Neither the Hatfield nor Benchmark models reflect these life-cycle effects or corresponding benefits. These omissions lead to an overstatement of the cost of providing universal service.

Mechanisms for measuring the cost of providing universal service

During the past two years, a great deal of effort has been devoted to designing a cost model that can be used to measure the cost of serving different communities. Currently, the large local exchange companies and the interexchange carriers are arguing over the merits of their respective cost models: the benchmark model, version two (BCM2), the cost proxy model (CPM), and the Hatfield model (HM). BCM2 was developed by US West and Sprint/United telephone. The cost proxy model was developed by Pacific Bell. The development of the Hatfield model was funded by AT&T and MCI.

In the Universal Service proceedings before the Federal Communications Commission, most attention has been focused on the merits of the BCM2 and HM. The CPM has received less attention,

[109]Analysis, "The Costs, Benefits and Funding of Universal Service in the UK," 19 July 1995, pp. 22-27. See, also, Oftel, "Universal Telecommunications Services: A Consultative Document on Universal Service in the UK from 1997 (December 1995), chapter 9.

in part, because the model was developed to measure the cost of providing service in California. Concern has been expressed over the ability of the model to provide meaningful estimates for other areas of the country.[110]

Benchmark cost model

Earlier this year, Sprint presented the Florida Commission with the results from the Benchmark Cost Model and recommended that the model be used for identifying areas that are relatively expensive to service.[111] Sprint noted that the model was not designed to develop either actual or embedded costs.

Sprint, working with US West, has developed an improved version of the Benchmark Cost Model. Benchmark Cost Model, version two (BCM2), has many enhancements. Its inputs include the current cost of installing and maintaining facilities. Overall, I am quite impressed by the model. I believe that the sponsors of BCM2 have developed an interesting, innovative analytical tool. The companies have done an admirable job of building a model that gives an *estimate* of the relative difference in providing service in different census block groups.[112] Like its first version, BCM2 is not designed to develop actual or embedded costs.[113]

In a filing made to the FCC, the Florida Public Service Commission submitted that "the BCM is the most promising proposal to compute the relevant costs to be used in deriving required universal service support. While no cost model can be perfected to cover all possible situations, we provisionally endorse the BCM as the basis for computing the costs of providing the core groups of basic services." Despite the Commission's statement to the contrary, the model was not designed to "yield estimates

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[110]See, for example, "Converging on a Cost Proxy Model for Primary Line Basic Residential Service: A Blueprint for Designing a Competitively Neutral Universal Service Fund," p. vi, prepared by Economics and Technology for the National Cable Television Association, August 1996.

[111]"Benchmark Cost Model: Presentation," April 3, 1996.

[112]Census block groups include between 250 and 550 housing units.

[113]"Benchmark Cost Model 2: Workshop," presentation made to New England Public Utility Commissions, September 5, 1996, p. 2.

of the required level of explicit subsidy..."[114] The model's sponsors have stated that it is designed to estimate relative costs, not cost levels. The use of the model should be limited to identifying the relative cost of serving different areas, which is actually what its sponsors consider the appropriate use of its output to be. But even here, some caution should be exercised due to the ten concerns identified below.

Some parties have attempted to judge the reasonableness of BCM2 by comparing its estimates to the embedded cost-of-service. These comparisons show that the BCM2 cost estimates exceed the embedded cost-of-service. This outcome is surprising in light of the reduction in the cost of important inputs that are used to provide the loop. This decline in the cost of inputs, especially digital line carrier, led Indiana Bell, for example, to find that the marginal cost of the loop declined by 87% between 1984 and 1993.[115] Whereas the current cost-of-production has decreased, I would expect to see BCM2's estimate of the current cost-of-production to be less than the embedded cost-of-service. Since the model does not provide reasonable estimates of the cost-of-production, it should not be used to set either the level of a universal service fund or the pricing of unbundled network elements.

There are a number of reasons why the model may be providing cost estimates that appear excessive. The following list identifies some of the problems with the model. The items listed below deal with both data and conceptual issues:

1) The model uses census block data to identify customer locations. The model runs feeder cable to each census block group. The cable used within the census block is characterized as the distribution cable. The demarcation point between the distribution cable and the feeder plant is referred to as a serving-area interface (when copper wire is used in the feeder plant). For those customers located far

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[114]"Comments," Florida Public Service Commission, "In the Matter of Federal-State Joint Board on Universal Service," p. 10 (second quote) and p. 11 (first quote), CC Docket No. 96-45, April 11, 1996.

[115]Prepared Testimony of David Gabel in Indiana Bell Telephone Company, p. 39, Cause No. 39705, Indiana Utility Regulatory Commission, January 1994.

from the central office, electronics are added to the feeder point. When electronics are added to the loop, the demarcation point is referred to as a carrier serving-area interface.

Unfortunately, census blocks have little to do with how telephone networks are engineered. A target census block has 400 households. Telephone networks are engineered to have 600 customers in an all-copper network and up to 2,000 subscribers when digital electronics are used in the feeder plant.[116]

2) The model starts with the list price of the equipment and then applies a discount factor. The net prices that are built into the model appear to be quite high, relative to what carriers actually pay for cable and switches. For example, BCM2 uses an investment per foot of $2.92 for a 400-pair aerial cable. The $2.92 only includes the cost of the material. This is only a portion of the cost of installing a cable. The capitalized labor time can be high, and it varies by such factors as topography and population density. BCM2 is a very sophisticated model that provides various labor-installation costs which depend on these factors. Indeed, the model is so complex that it is hard to say what a "typical" labor-loading is. Lacking such a number, I will use for illustrative purposes some data provided by Pacific Bell. Pacific Bell reports that "material accounts for only 18% of Pacific's entire loop investment."[117] Using a multiplier of three to account for capitalized labor time, the model would suggest a typical installed, equipped, and furnished investment of $2.92 X 3 = $8.76 per foot. A value that is quite high relative to some publicly available information. For example, New England Telephone reported a few years ago that their installed cost of the same size cable was in the range of $3.62 per foot.

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[116]This modeling problem can easily be remedied by working with census blocks, rather than census block groups. JSI, a consulting firm that uses Mark Kennet's and my LECOM software, has used census block data for some Independent telephone companies. JSI reports that by using census block data, customers are grouped together in a manner which comports with current engineering practices.

[117]Pacific Bell's Opening Brief in California Public Utilities Commission Rulemaking n the Commission's Own Motion into Universal Service, R.95-01-020, June 4, 1996, p. 48. Assuming that the 18% value is correct, the difference between cable material and total loop investment is not just capitalized labor time. Other investments include digital line electronics, poles, cabinets, etc.

3) In order to test the reasonableness of the outside plant investment values used in BCM2, I would like to compare the investment numbers it generated for Florida, Massachusetts, or some other State, with the prospective broad-gauge values used in the appropriate LEC's economic cost studies. Unfortunately, this can not be done. The model is not suited for this type of comparison. Since it works with a very large combination of outside plant costs that are intended to reflect variations in installation costs by soil type, gradient, and density. It is very difficult or impossible to compare these values with a carrier's forecasted costs. While there is no *a priori* reason to believe that either the LEC or BCM value is more appropriate, a regulatory commission should be aware of the difference and develop an understanding of why the variations exist.

4) The outside plant investment values were developed through a special study by the model's sponsors. The raw data used to prepare these values have not been disclosed; therefore, the model is not as "public" as its sponsors would suggest. Before the model is used for setting rate levels, it is essential that the data inputs be subjected to review.

5) The switching costs used in the model are substantially improved over BCM1. Nevertheless, there are a few significant problems:

a) The model lacks reasonable cost values for a small digital switch. In rural areas, many Independents use switches, such as the Redcom switch, which have cost characteristics that are much different than the values used in BCM2.

b) The model estimates the switch investments in a switch through a two-step process. First, the fixed cost of a switch is estimated. Second, the number of lines is multiplied by an investment-per-line value. The model lacks an algorithm that estimates the traffic sensitive costs of a switch.

c) After estimating the total cost of the switch, BCM2 assumes that a portion of its fixed cost of the switch is line related. This amount is based on the sponsors' estimate of the percentage of the switch that is non-traffic sensitive. They make the mistake of assuming that whatever is non-traffic sensitive is a line-related investment. This is a major error. For example, on many switches the central processor investment does not change when the volume of calls increases. Hence, the central

processor is typically characterized as non-traffic sensitive. But the central processor is used primarily for processing calls. The sponsors erroneously claim that the majority of the central processor investment is line related.

d) The model includes the cost of facilities used to provide some vertical services (e.g.; call waiting). The majority of the costs associated with providing vertical services are assigned to the cost of providing access to the network. None of the revenue from the vertical services is attributed in a like manner. Consequently there is a mismatch between revenues and costs.

6) The model does not directly reflect the investment in interoffice facilities (circuit equipment, SS7, or interoffice cables). Rather, it uses a factor to estimate these investments. This approach is acceptable for obtaining very rough estimates of interoffice costs, but it should not be used in any proceeding that endeavors to set the price of unbundled network elements.[118]

7) The model does not include any information on the usage per customer or the types of traffic. Cost models typically include information both on the level of usage and the routing of the customer calls. This is an important omission, because the level of usage in rural areas is typically much lower than it is in urban communities. For example, a study by New England Telephone showed that urban residential customers made 260% more calls per month than residential customers in rural locales. This difference was not addressed by the sponsors of the model. If it had been, the cost difference between urban and rural zones would have been reduced.

8) The model is designed to estimate the annual cost of exchange facilities. Non-facility-based costs are added on as a non-plant-related expense factor (i.e.: expenditures unrelated to depreciation, return, taxes, and maintenance of the facilities). Using data from ARMIS, the developers of the model summed up the costs for non-plant-related expenses (customer operations—marketing, customer

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[118]Since the majority of an LEC's investment is used for switching and the loop, I find it acceptable to develop a rough estimate of the cost of interoffice facilities just for the limited purposes for which that model is designed--to identify the relative cost of providing service in different areas.

operations—services, corporate operations, and miscellaneous depreciation expenses), and divided the value by the number of lines. The quotient was $133.39. They then assumed that 75% of this expense was related to providing universal service. This is a very poor assumption to make. For example, it is absurd to assume that 75% of the marketing costs are related to providing universal-service-related products.

9) The sponsors assume that the current cost-of-money is 11.25%. This numeration is considerably higher than the values recently adopted by State regulatory commissions, including the Florida Public Service Commission. For example, in the Universal Service Docket, the Commission concluded that the use of the 11.25% value in studies sponsored by SBT and GTEFL was inappropriate, because it was "higher than the intrastate rate of return approved by this Commission."[119]

10) The model appears to assume that no pole and conduit structural investments are shared with other utility services, such as electricity or cable television. This is not the common mode of operation and it leads to an overstatement of the cost-of-service.

Hatfield cost model

MCI and AT&T have sponsored the development of a second cost proxy model, the Hatfield model. Some of the concerns that I have raised about the Benchmark cost model also apply to the Hatfield model.

The Hatfield and Benchmark models are similar in many ways—they are both engineering models that are innovative, in part, for their efforts to tackle the difficult problem of identifying variations in the economic cost-of-service across the nation.

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[119]Re: Determination of funding for universal service and carrier of last resort responsibilities, Florida Public Service Commission, Docket No. 950696-TP, December 27, 1995, p. 25.

The developers of the Hatfield model claim that it can be used to estimate total service long run incremental cost levels, unlike BCM2 which only provides relative costs by region.[120] Before the model can be used for this purpose, certain data issues need to be addressed. In conjunction with some of the matters raised above, I have some additional concerns regarding Version 2.2, Release 1 of the Hatfield model.[121] Some of these issues may have been addressed in Release 2 of Version 2.2, a release that I have yet to closely review.

1) For both switching and digital line carrier facilities, the model works with an investment per line.[122] Due to the existence of certain "fixed" or "start-up" costs which are associated with installing the facilities, the model should be modified to estimate separately the line, usage, and fixed costs. The current procedure probably results in an underestimation of the total cost of serving rural areas and an overestimation of the cost in more urban areas.

2) The cable-fill factors appear to be high and could lead to an understatement of the total cost-of-service.

3) Operating expenses are estimated through a two-step process. First, using ARMIS data, the embedded ratio of expenses to investments is calculated. This ratio is then applied to the current investment values. There are two problems with this procedure. First, an embedded ratio should not be applied against current investments unless the cost of the facilities has been stable, a condition which has not been met. Second, the ARMIS data include expenses that are not associated with providing universal-service-related products.

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[120]"Hatfield Model," Version 2.2, Release 1, May 30, 1996, p. 1.

[121]At this time, I can not say which of the two models, in the aggregate, is better. Both need to be improved before they are used for setting rates.

[122]Ibid., pp. 30, 39.